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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/662,358	09/15/2000	Taiji Noda	0819-0423	1724

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EXAMINER

MAI, ANH D

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 02/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/662,358

Applicant(s)

NODA ET AL.

Examiner

Anh D. Mai

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-- **Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 January 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 1-5, 16 and 17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-15, 18 and 19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 September 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

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DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of invention Group I, claims 6-15, 18 and 19 in Paper No. 11 is acknowledged.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

3. Claim 8 is objected to because of the following informalities:

Lines 3 and 6: term "sidewall" is incorrect, the correct term should be: --sidewall spacer--. Appropriate correction is required.

4. Claim 19 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

The limitation of claim 19 is similar to that of claim 13, which it depends.

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Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 9, 11, 12 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 9, 11 and 12 are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

With respect to claim 9, how can the depth of the implanted heavy ions be both equal to or deeper than **and** shallower than a range of the first dopant at the same time ?

As best understood by the examiner, the depth of the heavy ions is shallower than that of the heavily doped sour/drain region.

With respect to claim 11, the limitation appears to be: "wherein the heavy ions are implanted at an energy level making a range of the first dopant (15) located inside the extended high-concentration dopant diffused layer (15)".

However, as shown in claim 6, the first dopant forms the extended high-concentration dopant diffused layer (lines 17-19).

How can a layer be inside (or shallower) than itself ?

With respect to claim 12, how can the depth of the implanted heavy ions be both equal to or deeper than **and** shallower (three time or less) than a range of the first dopant at the same time ?

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Regarding claims 9, 11, 12, the phrase "such ... as" in line 3, renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claim 14 recites the limitation "the indium ions" in lines 2-3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 6, 7, 11 and 12 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Kita (JP-06-267974).

Kita method for fabricating a semiconductor device as claimed including:

a first step of forming a gate electrode (3) over a semiconductor region with a gate insulating film (2) interposed therebetween;

a second step of implanting heavy ions (6) into the semiconductor region using the gate electrode (3) as a mask, thereby forming a first ion implanted layer (4), at least upper part of which is an amorphous layer;

a third step of implanting ions (7) of a first dopant into the semiconductor region, in which the amorphous layer (4) has been formed, using the gate electrode as a mask, thereby forming a second ion implanted layer (5) of a first conductivity type;

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and a fourth step of conducting a first annealing process to activate the first and second ion implanted layers, thereby forming an extended high-concentration dopant diffused layer of the first conductivity type through diffusion of the first dopant and a pocket dopant diffused layer, which is located under the extended high-concentration dopant diffused layer, through diffusion of the heavy ions, respectively, wherein the pocket dopant diffused layer includes a segregated part that has been formed through segregation of the heavy ions. (See Figs. 1-2).

With respect to claim 7, the segregated part of the pocket dopant diffused layer of Kita appears to overlap with a profile of the extended high-concentration dopant diffused layer.

With respect to claims 11 and 12, as best understood by the examiner, the depth of the heavy ions (4) of Kita is deeper than that of the first dopant (5).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 8, 9, 13, 14, 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kita '974 as applied to claim 6 above, and further in view of Sultan (U.S. Patent No. 5,970,353).

With respect to claim 8, Kita teaches that the MOS transistor is formed according to the usual process thereafter.

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Thus, Kita is shown to teach all the features of the claim with the exception of explicitly disclosing the formation of the heavily doped source/drain of the MOS.

However, Sultan further teaches the formation of the heavily doped source/drain of the MOS including:

forming a sidewall spacers (68) on the side faces of the gate electrode (52) after the formation of the LDD (62/67);

implanting ions of a third dopant into the semiconductor region (70) using the gate electrode (52) and the sidewall spacer (68) as a mask, thereby forming a third ion implanted layer (70) of the first conductivity type; and

conducting a second annealing process to activate the third ion implanted layer (70) of the first conductivity type, which is located outside of the extended high-concentration dopant diffused layer, has a junction deeper than that of the extended high-concentration dopant diffused layer and has been formed through diffusion of a second dopant. (See Fig. 7).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the heavily doped source/drain of Kita as taught by Sultan to complete the MOS device.

With respect to claim 9, as best understood by the examiner, the depth of the heavy ions (62) of Sultan is shallower than that of the heavily doped sour/drain region (70).

With respect to claim 13, 18 and 19, Kita is shown to teach all the features of the claim with the exception of using indium ions for the heavy ions (6).

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However, Sultan teaches that alternatively indium ions can be used in place of silicon to amorphize the substrate region.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to use indium ions for the heavy ions of Kita as taught by Sultan to amorphize the substrate region (4).

With respect to claim 14, as best understood by the examiner, the indium ions dose of Sultan is within the claimed range.

8. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kita '974 as applied to claim 6 above, and further in view of Anjum et al. (U.S. Patent No. 6,331,458).

Kita teach all the features of the claim with the exception of performing channel implant.

However, Anjum teaches performing threshold adjustment implant including:

implanting ions into a surface part of the semiconductor region (26), thereby forming a fourth ion implanted layer (28) of a second conductivity type before the formation of the MOS device; and

conducting a third annealing process to activate the fourth ion implanted layer (28), thereby forming a dopant diffused layer to be a channel region. (See Fig. 3).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to perform threshold adjustment implant on the channel region of the MOS device of Kita as taught by Anjum to alleviate the short channel effect.

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9. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kita '974 as applied to claim 6 above, and further in view of Tsukamoto (U.S. Patent No. 5,399,506).

Kita teaches conducting a first anneal process to activate the first (4) and second (5) implanted layer.

Thus, Kita is shown to teach all the features of the claim with the exception of explicitly disclose a specific annealing process.

However, Tsukamoto teaches that it is well known in the art to activate the dopants using RTA at 1050 °C for 10 seconds. Tsukamoto further teaches that the temperature increasing rate of 100 °C/sec is well known.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to activate the first and second implanted layers of Kita using RTA as taught by Tsukamoto activate the dopants.

Further, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum annealing temperature and the temperature rate of increase to activate the dopant. See *In re Aller*, Lacey and Hall (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
February 7, 2002



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